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(54) Improvements in or relating to manufacture of building blocks.

(57) An apparatus for manufacturing a building block is of the type having a mould box (1), and at least one core (3) rigidly mounted in the mould box by means of a spacer bar (4). At least a portion of the moulding surface of the core and/or the mould box is formed from a rubbery polymer. The polymer may be used as a coating (8) and/or the core (3) may be a moulding of the polymer. An undercut may be made in a block by providing a core (16) with an expandable resilient portion. The polymer may also be used to provide a cushion (8) under the lower edge of the mould box (1).

In the process using the apparatus the mould box (1) and core (3) are removed from uncured mould blocks after a very short time e.g. 1 to 60 seconds.

Improvements in or relating to Manufacture of Building Blocks

This invention relates to the manufacture of building blocks and particularly such blocks which contain cavities.

Building blocks of this type are conventionally made in an apparatus which includes a mould box and at least one core. The mould box is to mould the outer side walls of the block and typically consists of four sides but no top or bottom. In use the box is placed on a flat surface or on a purpose-built baseplate which then forms the base of the mould. Cavities are formed in the block by the presence of cores. The cores used to mould cavities in the block are attached rigidly to the mould box by means of spacer bars. To make a block a predetermined amount of damp particulate concrete mix is poured into the mould defined by mould box, flat surface and core a stripper plate is brought down onto the mix to function also as a top plate, and then the assembly is vibrated to consolidate the mix. Where a purpose-built baseplate is used the whole assembly is normally vibrated but if there is no baseplate, only the mould box is vibrated. The mould box and core are then lifted vertically away from the consolidated mix forming an uncured block which is subsequently cured. To facilitate its extraction from the uncured block the core may have a slight taper.

There are several areas where problems arise with the apparatus for making blocks in this way eg cores and walls tend to wear very rapidly and the vibration step generates a lot of noise.

Also, in our UK Patent Number 1 563 394 we have described a method for filling the cavity or cavities in a building block with an insulating plastics foam. Whilst such foam-filled blocks are now in widespread use and have excellent insulating properties we have found that in certain circumstances foam which has been injected into the block cavity can become loosened or dislodged particularly when the cavity has a taper.

Unexpectedly we have now found that in the manufacture of building blocks with cavities, the use of a resilient core in the moulding apparatus gives advantages which lead to improved block production. Such a core may further be adapted to produce blocks having cavities with undercut portions.

We have now also found that a major reduction in the level of noise generated in use of the apparatus can be achieved by judicious positioning of rubbery polymer in such apparatus.

We have also found that the use of a resilient polymer in the apparatus can give rise to a block mould whose interior surface has improved abrasion resistance over the conventional steel mould.

According to the present invention there is provided an apparatus for moulding a building block of the type comprising a mould box having sides but no base or top and at least one core rigidly attached thereto by means of a spacer bar, the core being to produce a cavity in the moulded block, wherein at least a portion of the moulding surfaces of the core and/or the mould box is formed from an rubbery polymer, such as a rubbery polyurethane.

The rubbery polymer may be incorporated into the apparatus as inserts or coatings on the surface of the mould box and/or the core but preferably the core is itself a resilient core which consists essentially of the rubbery polymer.

The resilient core may for example be a hollow, shaped core made of a rubbery polymer, such as a rubbery polyurethane.

The natural resilience of the material is beneficial, when a block is being moulded, in promoting compaction of the mix in the mould as the apparatus is vibrated in the usual manner.

Particularly suitable rubbery polymers are polyurethanes but other rubbery polymers may be used. The preferred rubbers have the following range of properties:-

a) high abrasion resistance to avoid rapid wear
b) good elasticity to ensure accurate shape retention
c) lack of creep
d) rapid recovery to original shape
e) sufficient rigidity to maintain shape under the loads imposed during block formation.
f) capable of good adhesion to the metal components of the mould box either directly or by use of adhesives

The apparatus may also be adapted to enable a block to be manufactured wherein a recess is provided in the walls of the cavity which, when the cavity is filled with insulating foam, will assist in preventing dislodgement of the foam. In this embodiment of the invention the apparatus comprises a core to generate the cavity, said core including a resilient portion which when expanded will form a recess in a wall of said cavity and when retracted will permit removal of the core from the cavity with the block in a green state.

The resilient portion of the core may for example be a portion, such as an end portion, made of a rubbery abrasion resistant polymer, such as a rubbery polyurethane, which in its expanded position includes a portion which extends laterally outwardly from the core to form the necessary recess.

A positive expansion and retraction of the resilient portion may be achieved if desired by using a hollow cross section core and a movable core spreader or bladder-like construction which can be expanded by application of fluid pressure and contracted either by virtue of natural resilience on removal of such pressure, or by evacuation.

In any embodiment of the apparatus the mould box may have, on that edge which is to abut against a flat surface onto which a block is to be moulded, a cushion of rubbery polymer.

The cushion of rubbery polymer reduces the noise generated during vibration of the apparatus during moulding of a block. Preferably the cushion is at least 3mm thick and it is particularly preferred that the cushion is 5 to 10mm thick.

The invention will now be particularly described, by way of example only, with reference to the accompanying drawings in which -

Figure 1 is an exploded diagram of the principal components of a block mould.

Figure 2 is a series of cross-sectioned views of a core on line A-A showing a mould core in accordance with one embodiment of the invention.

Figure 3 is a series of similar cross-sectional views illustrating a second embodiment of the invention.

Figure 4 is a series of similar cross-sectional views illustrating a third embodiment of the invention.

With reference to figure 1 a block mould consists of a mould box 1, transfer plate 2, cores 3 mounted on a spacer bar 4 and a pair of stripper plates 5.

In use to shape a block the mould box 1 and cores 3 are placed on the transfer plate 2, thus defining with the transfer plate an open-topped mould cavity. A metered amount of damp concrete mix is poured into the cavity, the top is closed by means of the stripper plates and the whole assembly is vibrated to ensure proper compaction of the mix to form a moulded block of correct dimensions. The mould box and cores can now be removed to leave the moulded block 6 on the transfer plate.

The stripper plates 5 are used to hold down the moulded block on the transfer plate whilst the mould box and cores are lifted off the moulded block 6, leaving the latter on the transfer plate 3 on which it is removed for curing. The time taken from the filling of the mould cavity to removal of the mould box and cores is in the range 1 to 60 seconds, for example 3 to 20 seconds. It will thus be appreciated that the concrete mix can not be sloppy since there is no appreciable cure taking place before the mould box is removed and the uncured block must then be free-standing.

Referring now to figure 2, the diagram illustrates in cross-section a mould box 1 and core 3 in position to be lowered on to a transfer plate 2 to form a cavity ready for concrete mix to be poured in.

The cores 3 are of conventional external shape, optionally tapered to facilitate their removal from inside a moulded block but they each are made from a rubbery polyurethane polymer which is highly abrasion resistant.

Each core 3 is a hollow shape, which has been formed on the spacer bar 4.

The mould box 1 is provided with a cushion 7 on its lower edge and a coating 8 of the same polymer on its interior walls.

In use the resilience of the cores aids the compaction of the mix during the vibration stage referred to above.

The rubbery polyurethane from which the cores are made may for example be derived from a polyether polyol of 1000 mol.wt, such as Terathane 1000 commercially available from Du Pont, and methylene diphenyl isocyanate (MDI).

Thus the cores may be cast onto the spacer bar in moulds at 90°C to 100°C using a mixture of 918 parts by wt of the polyol and 282 parts of MDI.

As shown in diagram 2B when the mould box 1, is placed on a transfer plate and pressed on to it, the cushion 7 comes into contact with the transfer plate. As the mould box and transfer plate are conventionally made of steel, this prevents metal to metal contact and reduces noise.

The coating 8 of polymer on the walls of the mould box also reduces noise and improves the life of the mould box. The preferred polymer for cushion, coating and core is a rubbery polyurethane; for example one made from a polyether polyol of mol.wt 1000 such as Terathane 1000 (commercially available from Du Pont) and methylene diphenyl isocyanate (MDI).

The coating 8 may be cast onto the metal walls of the mould box at 90°C to 100°C using a mixture of 918 parts by weight of the polyol and 282 parts of MDI.

In the second embodiment of the invention shown in figure 3 the cores are modified to facilitate their expansion inside the mould box and enable a block to be moulded with a cavity which is better adapted subsequently to retain a foam filling.

Referring now to figure 3, diagram A illustrates a mould box 1 and conventional core 9 in position on a transfer plate 2 forming a cavity ready for concrete to be poured in.

Diagram B illustrates a modified core 10 which is made of a flexible material such as a rubbery polyurethane, and which is provided with a core spreader 11 of a rigid material such as steel.

As shown in diagram C when the modified core 10 is placed with a mould box 1 on a transfer plate 2 and pressed on to it, the core spreader is first to come into contact with the transfer plate. As the mould box and core 10 are lowered on to the transfer plate 2 the core spreader 11 slides up into the hollow interior of the core 7 and is maintained in alignment within it by engagement of a guide rod 12 in a hole in an internal web 13 in the core 10. The effect of the core spreader is to force apart the lower portions of the core 10 so that when in position in the mould box the widened core defines an undercut in the mould cavity shape.

After a block has been moulded using the modified core, removal of the core and mould box from the transfer plate is accomplished as usual since the upward movement of the core 10 will initially serve to lift it off the core spreader 11 and so the core 10 will contract and slide out

A head 14 on the guide rod 12 will eventually arrest relative movement of the core 10 and core spreader 11 and cause the core spreader to lift away from the moulded block with the core.

In the third embodiment of the invention illustrated in figure 4 the cores are of a similar kind to those of figure 3 but have an alternative spreader mechanism. Figure 4 also illustrates use of an apparatus with no baseplate.

Referring now to figure 4, diagram A shows a mould box 1 and a core 16 mounted on a spacer bar 4. The mould box is suspended above a flat base 15 which could be, for example, a smooth concrete floor.

The core 16 is a hollow moulding of rubbery polymer having the conventional, slightly tapered, external shape but ledges 17 are moulded into its internal walls adjacent to the bottom of the core. The spreader mechanism is very simple and consists only of a thick section 18 of a stiff rubbery polymer (which could be the same material as the core 16) which is V-shaped in cross-section with the apex of the "V" extending below the bottom of the core and the ends of the arms of the "V" being adhered to the ledges 17 on the inner side of the walls of the core.

When in use the mould box and core assembly is lowered on to a flat surface the apex of the "V" shaped sheet 18 contacts the surface first then as the core 16 is lowered further the effect is to flatten the "V", and thus force outwardly the lower portions of the sides of the core. It will be appreciated that in this embodiment the sheet 18 functions as a simple hinge and could be replaced by a metal hinged spreader to perform the same function.

CLAIMS:-

1. An apparatus for moulding a building block of the type comprising a mould box (1) having sides but no base or top and at least one core (3) rigidly attached thereto by means of spacer bar (4), the core being to produce a cavity in the moulded block characterised in that at least a portion (8) of the moulding surfaces of the core and/or the mould box is formed from a rubbery polymer.

2. An apparatus according to claim 1 in which said polymer is a rubbery polyurethane.

3. An apparatus according to claim 1 or 2 in which the core (3) is a resilient core which consists essentially of a rubbery polymer.

4. An apparatus according to claim 1, 2 or 3 in which the core (3) is moulded from said polymer.

5. An apparatus according to claim 4 in which the core is formed on a metal spacer bar (4).

6. An apparatus according to any preceding claim in which the core (3) is a hollow moulding of said polymer.

7. An apparatus according to any of the preceding claims wherein said core (10, 16) includes a resilient portion which when expanded will form a recess in a wall of said cavity and when retracted will permit removal of the core from the cavity with the block in a green state.

8. An apparatus according to claim 7 in which said resilient portion of the core member is made of a rubbery polymer.

9. An apparatus according to claim 7 or 8 which includes means (11, 18) for expanding the core member (10, 16) to form a portion which expands laterally outwardly when in position inside a mould to form a cavity having an undercut portion.

10. An apparatus according to claim 9 in which the core member is moulded from a rubbery polymer and the means to expand the core is a core spreader (11, 18) which will force apart resilient portions of said core member when in use.

11. An apparatus according to any one of the preceding claims wherein the mould box has on that edge which is to abut against a flat surface onto which a block is to be moulded a cushion (7) of rubbery polymer.

12. An apparatus according to claim 11 in which the cushion (7) has a thickness of 5 to 10 mm.

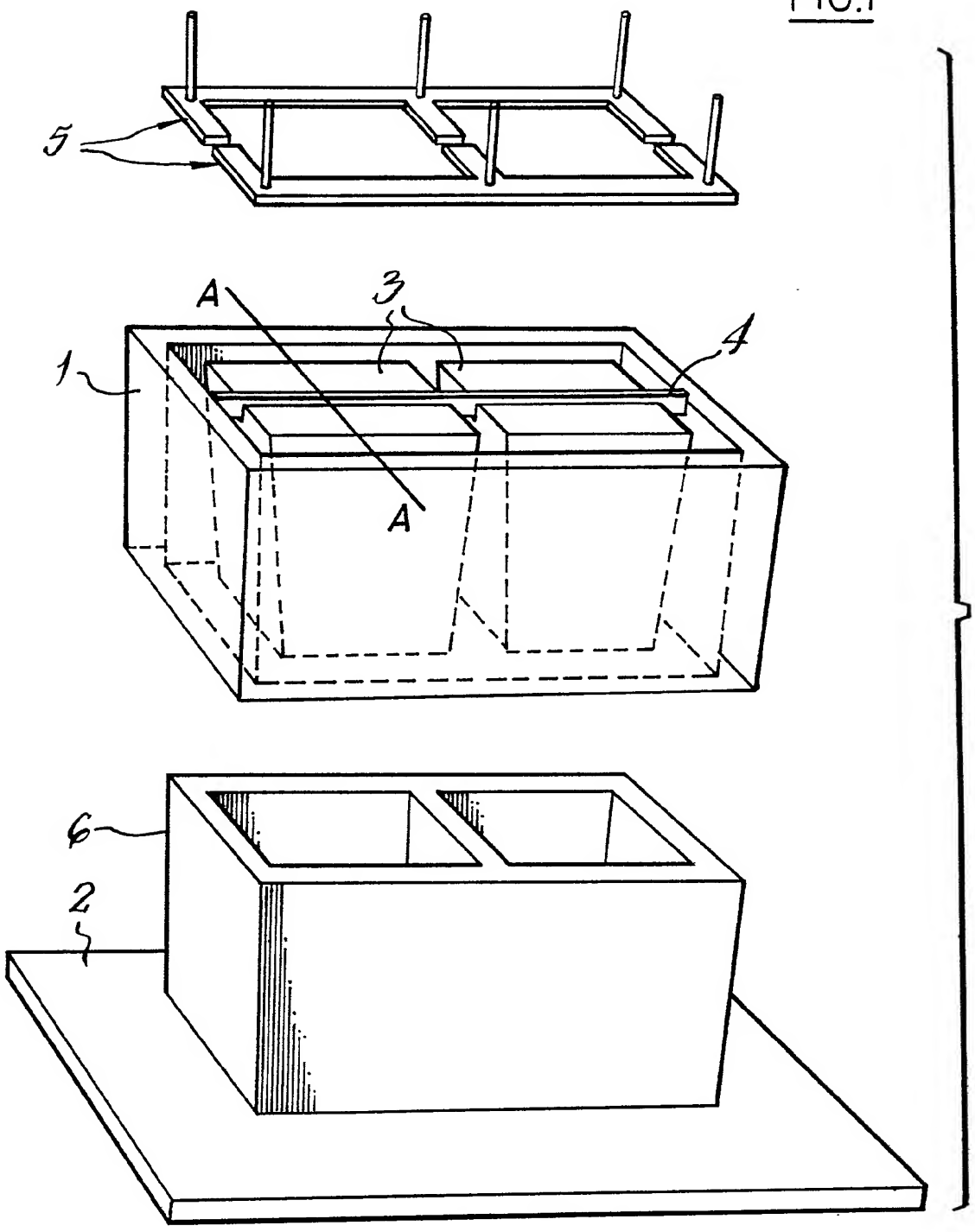
13. An apparatus according to claim 11 or 12 in which said rubbery polymer is a rubbery polyurethane.

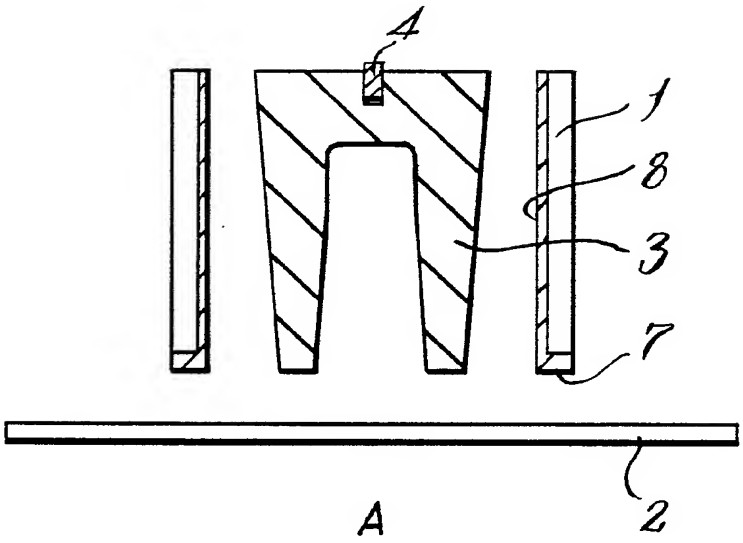
14. A process for the manufacture of a building block in an apparatus as claimed in any one of the preceding claims wherein the mould box and core assembly is lowered onto a flat surface, a damp concrete mix is poured into the mould cavity so formed, the top of said cavity is closed by means of one or more stripper plates, the apparatus is vibrated and then the mould box and core assembly is lifted away using the stripper plates to hold down the uncured block on the flat surface.

15. A process according to claim 14 wherein the time taken from the filling of the mould cavity to removal of the mould box and core assembly is in the range 1 to 60 seconds.

16. A process according to claim 15 wherein said time is in the range 3 to 20 seconds.

FIG.1





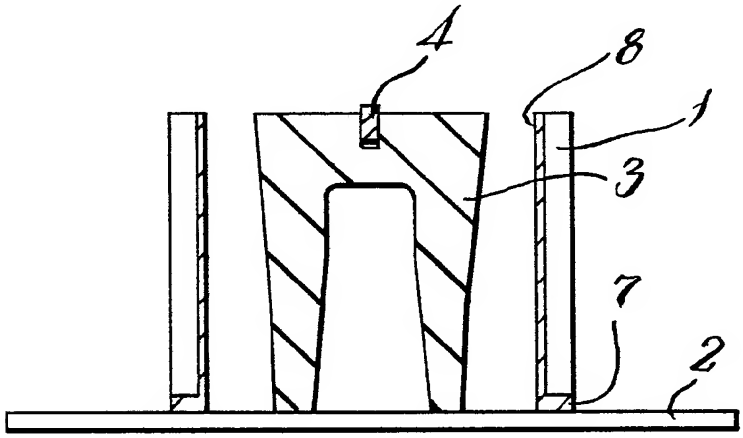
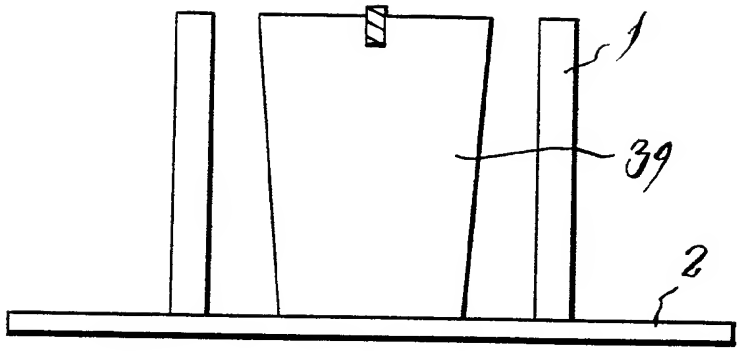
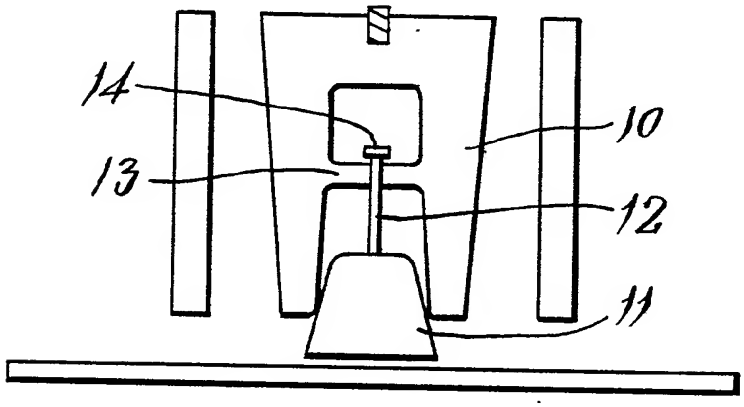


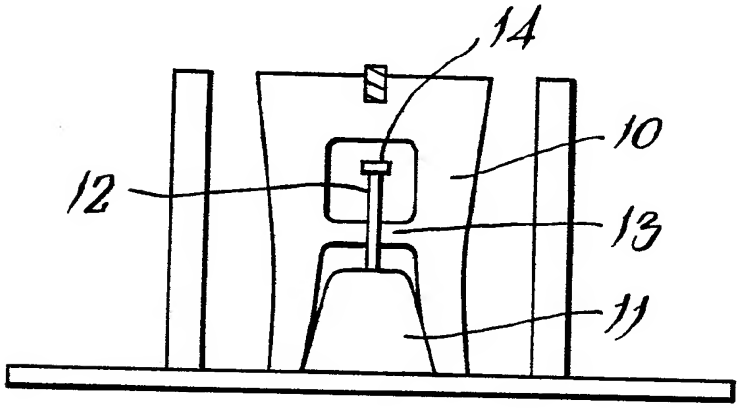
FIG.2



A

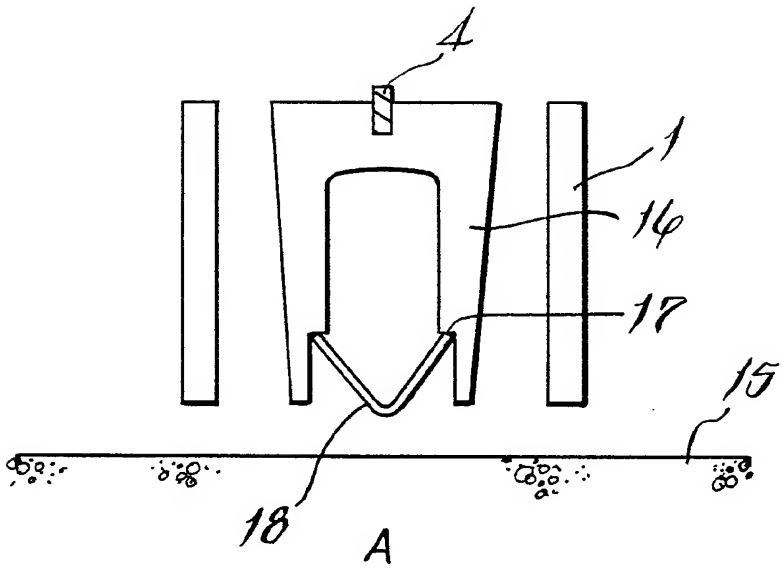


B



C

FIG.3



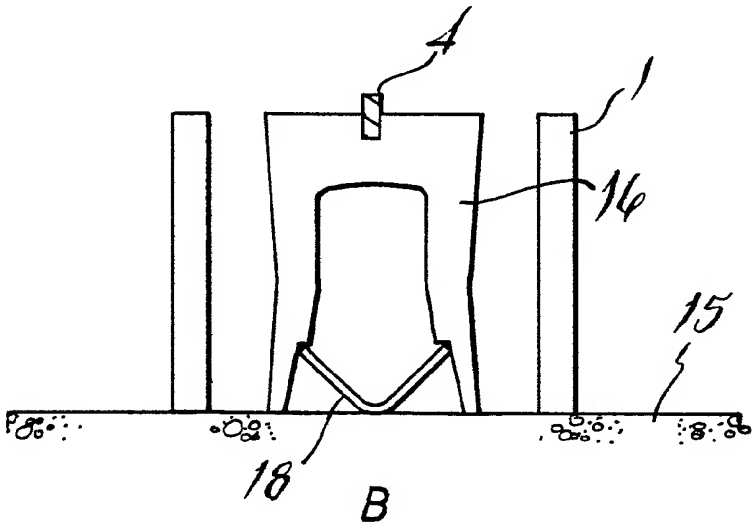


FIG.4